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Economic Analysis of the Potential Closure Impact of the Final Steel Industry Effluent Guidelines Regulation

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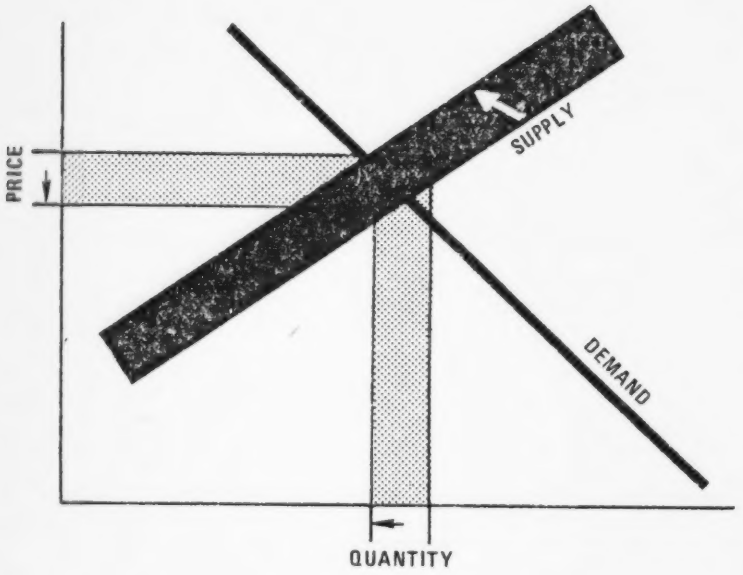

ECONOMIC ANALYSIS OF THE POTENTIAL CLOSURE IMPACT OF THE FINAL STEEL INDUSTRY EFFLUENT GUIDELINES REGULATION

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An analysis of the potential closure impact of increased costs associated with water pollution control on twelve (12) model steel plants patterned after twelve domestic steel plants identifed as likely to be most seriously affected by the final iron and steel effluent guidelines. The additional costs associated with the regulation ranged from $0.21 to $2.60 per net ton and averaged only $0.82 per net ton. It was concluded that cost increases of this magnitude would be unlikely to force the closure of any of the model plant configurations or processes that were analyzed.

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ECONOMIC ANALYSIS OF THE POTENTIAL CLOSURE IMPACT OF THE FINAL STEEL INDUSTRY EFFLUENT GUIDELINES REGULATION

A. EXECUTIVE SUMMARY

As part of a larger analysis of the economic impact of the steel industry effluent guidelines regulation completed for the Agency by Temple, Barker and Sloane, Putnam, Hayes & Bartlett has analyzed the potential closure impact of increased costs associated with water pollution control on 12 individual model steel plants. The configurations of these model plants were patterned after 12 specific domestic steel plants previously identified as likely to be most seriously affected by the regulation. The production cost estimates derived from the plant models are based on the assumption that each process in each plant model has national average operating characteristics and that each plant must pay national average prices for its inputs of raw materials and labor. Therefore, production cost estimates should not be attributed to the actual plant whose process configuration forms the basis for the model.

The Operations Update Analysis prepared by EPA's technical contractor provided estimates of the total operating costs, including the capital recovery costs of prospective additional investment, associated with in-place, BPT and BAT levels of water pollution control for each of the 12 model plants. For each model plant analyzed, the increase in total operating costs, including the capital recovery costs of additional investment associated with meeting both the BPT and the BAT standards, ranges from 0.06 to 0.64 percent of total production cost and averages 0.21 percent. On a dollars per shipment ton basis, the additional costs associated with meeting both the BPT and the BAT standard range from $0.21 to $2.60 per net ton and average only $0.82 per net ton. On this basis, Putnam, Hayes & Bartlett has concluded that the increases in operating and capital costs associated with meeting this regulation would be unlikely to force the closure of any of the model plant configurations analyzed.

Partial closure (that is, closure of one or more finishing mills) would be predicted if, as a result of

compliance with the regulation, a finished product no longer generates revenues in excess of variable production costs plus avoidable cash fixed costs. For the 12 plants analyzed, additional operating costs associated with meeting both the BPT and BAT standards for the primary coking, iron and steelmaking processes accounted for most of the costs which could be allocated to a specific process. Operating cost increases associated with finishing processes generally reflect centralized treatment facilities whose costs are borne by a number of different finishing processes. The analysis did not indicate any finishing processes for which the additional operating costs attributable solely to that process were sufficient to indicate a likelihood of partial closure.

B. INTRODUCTION AND LIMITATIONS

As part of a larger analysis of the economic impact of the steel industry effluent guidelines regulation completed for the Agency by Temple, Barker and Sloane (TBS), Putnam, Hayes & Bartlett (PHB) analyzed the likely impact of the regulation on individual steel plants. The primary purpose of this analysis was to determine whether increased costs associated with compliance with the BPT and BAT limitations are likely to result in closures or partial closures of those integrated steel plants covered by the regulation. In order to perform this analysis, PHB first undertook a broad screening analysis to determine specific plants most likely to be seriously affected by regulation. Various indicators of corporate financial strength, product mix profitability, and relative competitive strength by plant were reviewed in order to rank actual steel plants by likely degree of impact. Details of this analysis are given in Appendix 1 of this report. Based on the results of the screening analysis, 12 plants were selected in consultation with, and with the approval of EPA as likely to be most seriously affected by the BPT and BAT steel industry regulation. The plants selected for detailed analysis are listed below:

	Company	Plant
1.	Bethlehem Steel	Lackawanna, NY
2.	Jones & Laughlin	Cleveland, OH
3.	Jones & Laughlin	Indiana Harbor, IN
4.	Kaiser Steel	Fontana, CA
5.	McLouth Steel	Trenton, MI
6.	National Steel	Weirton, WV
7.	Republic Steel	Gadsden, AL
8.	Sharon Steel	Farrell, PA
9.	U.S. Steel	Fairless, PA
10.	U.S. Steel	Geneva, UT
11.	U.S. Steel	Homestead, PA
12.	Wheeling-Pittsburgh	Steubenville, OH

PHB formulated 12 model steel plants based on the configurations of production processes present at each of these 12 specific domestic steel plants. For purposes of this study, the production cost estimates derived from PHB plant models are based on the assumption that each process in each plant has national average operating characteristics and that each plant must pay national

average prices for its inputs of raw materials and labor. Therefore, the production cost estimates derived in the analysis should not be attributed to the actual plant whose process configuration forms the basis for the model.

C. SUMMARY OF METHODOLOGY AND RESULTS

The individual steel plant models developed by PHB were designed to calculate the minimum cost of producing a given mix of end products, assuming the input factor costs, process configurations and capacity limitations specified in the models. Production costs calculated in the plant models reflect direct cash costs, including cash overhead and allocated selling, administrative and general expenses (S,G&A). Noncash costs such as depreciation and indirect costs such as corporate interest or taxes are not included in the plant model cost estimates. Because 1980 was a relatively depressed year in terms of shipment tonnage and because plant-specific production data are available only from steel company 308a responses covering the years 1974 to 1976, PHB has attempted to determine an "average" expected tonnage level and product mix for each plant based on the best information currently available regarding the most likely pattern of future shipments.*

The results contained in this study reflect 1980 input factor costs, i.e., labor costs, ore costs, electricity costs, etc., and are expressed in 1980 dollars. All input factor prices reflect national averages and are consistent with those in the TBS industrywide impact study, except for purchased coke costs which were not estimated by TBS. The use of national average input factor prices is further discussed in Appendix 3. The Cyrus Rice Division of NUS Corporation, the Agency's technical contractor, provided estimates of the total operating costs, including the capital recovery costs of additional investment, associated with in-place, BPT and BAT levels of water pollution control for each of the 12 model plants. Capital recovery costs were calculated using a capital recovery factor of 0.0899. This factor reflects recent changes in the tax laws and is consistent with the interest rate and debt-financing

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* Obtaining more recent data would have required a new data request imposing an additional burden on the companies involved. In addition, these data are generally considered to be extremely confidential. Moreover, it would not have been possible to obtain these data and to meet the court-ordered deadline of 31 January 1982.

assumptions made in TBS' industrywide analysis. Estimates of the total operating costs associated with in-place air pollution control equipment were derived from estimating equations developed for the Agency by PEDCo Environmental, Inc.

The results of the analysis are summarized in Tables C-1 and C-2. As shown in Table C-1, for the 12 model plants analyzed, the increase in total operating costs associated with meeting the BPT limitations ranges from zero to 0.20 percent and averages 0.07 percent. The increase in total operating costs associated with meeting both the BPT and the BAT limitations ranges from 0.06 to 0.64 percent and averages 0.21 percent. As shown in Table C-2, on a dollars per shipment ton basis the additional operating costs associated with meeting the BPT limitations range from zero to $0.77 per net ton and average $0.29 per net ton. The additional costs associated with meeting both the BPT and the BAT limitations range from $0.21 to $2.60 per net ton and average $0.82 per net ton. On a dollars per shipment ton basis, the largest impact of meeting the BAT limitations is seen at the model configuration of the Republic Steel Gadsden plant. The relatively high cost of $2.60 per ton stems from an unusual need for a storm water diversion system to reduce the volume of water that might flow through various treatment processes.

On the basis of these results PHB concludes that the increases in operating costs, including capital recovery costs, associated with meeting the final steel industry regulation would be unlikely to force the closure of any of the model plant configurations analyzed.

Partial closure (that is, closure of one or more finishing mills) would be predicted if, as a result of compliance, a finished product no longer generates a total contribution* in excess of its own avoidable cash fixed costs. For the 12 plants analyzed, additional operating costs associated with meeting both the BPT and BAT limitations for the coking, iron and steelmaking processes accounted for most of the costs which could be allocated to a specific process. Operating cost increases

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* For purposes of this study, contribution is defined as revenues less variable production costs.

Table C-1

IMPACT OF BAT STEEL INDUSTRY REGULATION ON AVERAGE PRODUCTION COST PER NET TON BY PLANT

Model Configuration (Company/Plant)	Average Production Cost per Net Ton at Various Levels of Control (1980 $/NT)						Percentage Increase in Production Costs*	
	None	In-Place Air	In-Place & Additional Air	All Air & In-Place Water	After BPT	After BPT & BAT	BPT	BAT
Bethlehem Steel/ Lackawanna	393	394.83	395.62	397.80	398.38	398.90	0.15	0.28
Jones & Laughlin/ Cleveland	364	364.30	364.46	365.12	365.16	365.33	0.01	0.06
Jones & Laughlin/ Indiana Harbor	409	410.36	411.11	412.30	412.50	412.83	0.05	0.13
Kaiser Steel/ Fontana	447	449.80	450.14	451.76	452.39	452.55	0.14	0.17
McLouth Steel/ Trenton	330	330.37	330.52	333.99	334.12	334.28	0.04	0.09
National Steel/ Weirton	431	432.13	432.75	433.96	434.11	434.85	0.03	0.21
Republic Steel/ Gadsden	404	405.71	406.81	405.12	405.39	407.72	0.07	0.64
Sharon Steel/ Farrell	382	382.59	382.88	383.80	384.15	384.39	0.09	0.15
U.S. Steel Fairless	388	388.85	389.23	390.82	391.59	391.88	0.20	0.27
U.S. Steel/ Geneva	374	375.47	376.45	375.57	375.57	376.51	0.00	0.25
U.S. Steel/ Homestead	426	426.63	427.11	426.84	427.04	427.18	0.05	0.08
Wheeling-Pittsburgh/ Steubenville	347	348.37	349.10	351.58	351.73	352.03	0.04	0.13
12-Plant Average Increase in Cost per Ton							0.07	0.21

* Percentage increase in cost per ton relative to the all air plus in-place water pollution control baseline cost.

Table C-2

WATER POLLUTION CONTROL
ESTIMATED OPERATING AND CAPITAL RECOVERY COSTS
($ 1980/NT)

Model Configuration (Company/Plant)	Assumed Shipment Tonnage (M NT)	In-Place	Additional Treatment Levels (Incremental) BPT	BAT	Total Additional Cost
Bethlehem Steel/ Lackawanna	2.0	$2.18	$0.58	$0.52	$1.10
Jones & Laughlin/ Cleveland	2.2	0.66	0.04	0.17	0.21
Jones & Laughlin/ Indiana Harbor	2.0	1.19	0.20	0.33	0.53
Kaiser Steel/ Fontana	1.6	1.62	0.63	0.16	0.79
McLouth Steel/ Trenton	1.8	3.47	0.13	0.16	0.29
National Steel/ Weirton	2.6	2.96	0.15	0.74	0.89
Republic Steel/ Gadsden	0.7	-1.69*	0.27	2.33	2.60
Sharon Steel/ Farrell	1.1	0.92	0.35	0.24	0.59
U.S. Steel/ Fairless	2.9	1.59	0.77	0.29	1.06
U.S. Steel/ Geneva	1.7	-0.88*	0.00	0.94**	0.94
U.S. Steel/ Homestead	2.15	-0.27*	0.20	0.14	0.34
Wheeling-Pittsburgh/ Steubenville	2.05	2.48	0.15	0.30	0.45
12-Plant Average Cost per Ton		$1.19	$0.29	$0.53	$0.82

* Negative operating costs result from credits for by-products such as mill scale, acid, etc.

** Includes some consent decree requirements.

associated with finishing processes susceptible to partial closure generally reflect centralized treatment facilities whose costs are borne by a number of different finishing processes. The largest impact on a single finishing process was approximately $438,000 per year in additional operating costs associated with meeting the BPT limitations at the rod mill at U.S. Steel's Fairless Hills plant. The rod mill represents an unusual case where geographical considerations require installation of certain treatment facilities specifically to serve the rod mill. Virtually all of this cost is a relatively fixed cost associated with capital recovery and labor. Therefore, the per unit contribution of rod output will not be appreciably reduced. However, absorption of this cost will require an additional contribution of approximately $1.00 per ton based on an assumed shipment tonnage of 400,000 tons. Operating the mill at its reported capacity of 780,000 tons would reduce the impact of the additional contribution to about $0.60 per ton. Our analysis did not indicate any finishing processes for which the additional operating costs attributable solely to that process were sufficient to indicate a likelihood of partial closure.

D. PLANT MODELS AND ASSUMPTIONS

1. The PHB Plant Models

The individual steel plant models formulated by PHB are designed to calculate the minimum cost of producing a given mix of end products, assuming the process configurations and capacity limitations specified in the models. The individual steel plant models were constructed using the input factor usage rates and material balance yields contained in the Arthur D. Little/ American Iron and Steel Institute database. This database was initially developed by ADL with the cooperation of AISI as part of ADL's 1975 industry study, "Steel and the Environment -- A Cost Impact Analysis." The database was refined and updated as part of the 1978 ADL follow-up study of the same title. The updated database reflects 1976 operating conditions and incorporates information from 100 of the 129 AISI member plants. The 100 plants that contributed to the updated database accounted for about 87.7 percent of 1976 U.S. total raw steel capacity and 83.6 percent of 1976 raw steel production.

The ADL/AISI database provides information on input factor usage rates and material balance yields for each of 27 distinct iron and steel production processes. The ADL/AISI database summary available to the Agency reflects the average operating characteristics of each process in the database. Thus, the plant models developed by PHB based on this database calculate production costs assuming that a plant has average operating characteristics for each of the production processes contained in its configuration.

Baseline production costs calculated by the plant models reflect direct cash costs, including allocated cash overhead and selling, administrative and general expenses (S,G&A). Noncash costs such as depreciation and indirect costs such as corporate interest or taxes are not included in these plant model cost estimates. The allocations of overhead and S,G&A to various plants and processes reflect the practices of the steel companies making the original data submissions to ADL/AISI.

Although steel plant overhead and S,G&A expenses are largely fixed costs with respect to tonnage, the ADL/AISI

summary database reports these costs on a normalized "per ton" basis. Thus, the magnitude of the overhead cost component depends on the tonnage assumption used to "reconstitute" the original total dollar figure. The plant models incorporate an estimate of fixed overhead derived by applying the ADL/AISI per ton overhead factors to the tonnage flow at each process given an output level and product mix which approximates that experienced in 1976 when the ADL/AISI database was compiled.

The plant models are based on the process configurations and capacities reported for each plant in the Operations Update Analysis prepared by the Cyrus Rice Division of NUS Corporation. The process configurations and capacities reported are based on 308a questionnaire responses received from steel companies. Capacity figures for "Phase I" iron and steelmaking processes were based on reported rated capacities. Capacity figures for "Phase II" finishing processes were based on peak actual production.

The plant models reflect the minimum cost of producing a specified tonnage and product mix. Because 1980 was a relatively depressed year in terms of shipment tonnage (particularly for light flat-rolled products), and because plant-specific production data are generally available only from steel company 308a responses covering the years 1974 to 1976, PHB determined an "average" expected tonnage level and product mix for each plant based on the best information currently available regarding the most likely pattern of future shipments. The finished product demands imposed on each plant model to generate production cost estimates are summarized in Table D-1 on the following page.

In the case of the model patterned after the U.S. Steel Homestead plant, a number of adjustments were necessary to reflect more accurately the processes at that plant. The information compiled by the technical contractor indicates that the Homestead/Rankin complex has no coking or sintering capacity and only about 1.61 million tons of blast furnace hot metal capacity. However, the U.S. Steel Homestead/Rankin complex, along with other U.S. Steel plants in the Monongahela Valley, is provided with coke and coke-oven gas from the nearby Clairton coke plant. Also, the U.S. Steel Saxonburg sinter plant provides large-scale sintering capability to

Table D-1

FINISHED PRODUCT DEMAND (Millions of Net Tons)

Company/Plant	Structurals	Hot-Rolled Sheet	Hot-Rolled Sheet Pick. & Oil	Cold-Rolled Sheet	Tin Mill Products	Galvanized	Pipe	Bar	Rod	Plate	Plate Pick & Oil	Total Tonnage
Bethlehem Steel/ Lackawanna				1.0		.4		.6				2.0
Jones & Laughlin/ Cleveland		.9	.3	1.0								2.2
Jones & Laughlin/ Indiana Harbor		.6	.2	.4	.5	.3						2.0
Kaiser Steel/Fontana		.4	.1		.4	.2				.5		1.6
McLough Steel/Trenton		.8	1.0									1.8
National Steel/Weirton		.9	.1		1.0	.4						2.6
Republic Steel/Gadsden		.2		.1		.1				.3		.7
Sharon Steel/ Farrell		.4	.1	.4		.1						1.1
U.S. Steel/Fairless		.7		.5	.6	.2	.3	.2	.4			2.9
U.S. Steel/Geneva	.4	.8					.1			.4		1.7
U.S. Steel/Homestead	.7									1.4	.05	2.15
Wheeling-Pittsburgh/ Steubenville		1.0	.5	.5		.05						2.05

the U.S. Steel plants in the Monongahela Valley, including the Homestead/Rankin complex. Furthermore, approximately 0.77 million tons of excess blast furnace capacity at the Edgar Thomson Works in Braddock is available to Homestead via submarine ladle car. Therefore, for purposes of this study, the Homestead plant configuration was modeled assuming 2.38 million tons of hot metal capacity and assuming that hypothetical 1.2 million ton coking and 1.08 million ton sintering facilities were available at the Homestead site.

Process flow diagrams showing the plant configuration, process capacities, end product mix and intermediate process flows for each of the 12 plants PHB has modeled are included in this study as Appendix 2. All figures are given in millions of net tons. Within each box representing a process step, figures to the left of the slash represent the process operating level, while figures to the right of the slash represent the assumed annual capacity of the process. The notations S, M and L indicate whether the process is classified as a small, medium or large one for purposes of applying the ADL/AISI database.

2. Input Factor Costs

The plant model cost estimates reflect 1980 factor costs and are expressed in 1980 dollars. With the exception of purchased coke costs, factor costs were taken from the Agency's Economic Analysis of Final Effluent Limitations Guidelines. These factor costs reflect national averages and are summarized below.

INPUT FACTOR COSTS ($ 1980)

Labor	$18.45/hr.
Ore	See text below
Met. Coal	$63.90/NT
Scrap	$91.62/NT
Fuel	$3.64/mmBTU
Power	$0.034/KWH
Purchased Coke	$110.00/NT*

In addition to these input factor costs, the production cost functions contained in the plant models also include

a summation of the ADL/AISI estimated overhead and S,G&A cost and maintenance, other raw materials, other utilities and miscellaneous costs per ton for each process step. These ADL/AISI 1976 dollar figures are the best available data and were inflated to 1980 dollar values using the price indices contained in the Agency's industrywide study.

PHB used different ore cost figures for each plant to reflect expected differences in the proportions of sinter, lump ore and pellets used to charge the blast furnaces. The ADL/AISI factor usage rates assume the following standardized ore mix:

	Ore Inputs (NT/NT Hot Metal)	Ore Cost ($ 1980/NT)
Pellets	.86	$38.74
Sinter	.45	--
Lump Ore	.19	22.89
Total	1.50	

For plants without a sinter strand, PHB assumed that pellets would be substituted for sinter. For these plants, an ore cost of $36.72/NT was used, based on the following calculation:

$$[((.86 + .45) * \$38.74) + (.19 * \$22.89)]/1.50 = \$36.72$$

For plants with a sinter strand, PHB assumed that the sinter strand would be operating at 85 percent capacity utilization, the average capacity utilization underlying the ADL/AISI database. Remaining ore needs were balanced with pellets, such that sinter, pellet, and lump ore requirements totaled 1.5 times hot metal requirements. Ore cost was then calculated as a weighted average, with the lump ore and sinter proportion of total ore needs valued at $22.89/NT and the pellet proportion valued at $38.74/NT. The costs of processing the lump ore required as input for the sinter strand is included in the

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* This estimate derived by PHB.

production costs estimated by the models. The estimated ore costs by model plant are summarized below:

Company	Model Plant	Weighted Average Ore Cost (1980 $/NT)
Bethlehem Steel	Lackawanna	$31.19
Jones & Laughlin	Cleveland	36.72
Jones & Laughlin	Indiana Harbor	31.13
Kaiser Steel	Fontana	29.78
McLouth Steel	Trenton	36.72
National Steel	Weirton	27.15
Republic Steel	Gadsden	30.67
Sharon Steel	Farrell	36.72
U.S. Steel	Fairless	28.26
U.S. Steel	Geneva	30.34
U.S. Steel	Homestead	31.92
Wheeling-Pittsburgh	Steubenville	34.52

The price of purchased coke was based on production costs indicated for on-site coke production, as well as data collected on Form EIA 5, "Coke Plant Report Quarterly" by the Energy Information Administration (EIA) of the U.S. Department of Energy. The EIA data indicate that purchased coke for blast furnace use had an average price of about $100 per net ton in 1980. However, this figure does not reflect transportation costs and is very heavily influenced by transfer-pricing practices at integrated steel works. The EIA data also indicate an average 1980 merchant coke price of around $116 per net ton. However, this figure is heavily influenced by shipments of higher-grade foundry coke and does not reflect transportation costs. In addition, the EIA data are heavily influenced by spot prices whereas the plants which rely on purchased coke generally purchase under long-term contracts. PHB assumed that the purchased coke price would be at least high enough such that the plants with on-site cokemaking would choose to produce their own coke, as opposed to purchasing off-site coke. On this basis, PHB used a purchased coke price of $110 per ton delivered, which is consistent with the range of EIA data.

3. Capital Recovery Factor

The purpose of a capital recovery factor is to annualize capital investment costs over the useful life of an asset. Annualizing capital investment costs using a capital recovery factor procedure is not the same as using a depreciation schedule to calculate depreciation expense for accounting purposes. The purpose of a depreciation schedule is to match the historic cost or book value of an investment with accounting revenues occurring over the useful life of the asset. A capital recovery factor indicates the magnitude of a series of periodic cash flows which, over the useful life of the asset, will have a discounted present value equal to the discounted present value of the investment. The discounted present value of an investment is generally not the same as its book value due to the impact of investment tax credits, tax-deductible noncash expenses such as depreciation and tax-deductible investment-related expenses such as interest and property taxes.

In accordance with the assumptions contained in TBS' study for EPA, PHB assumed that pollution control capital expenditures would be financed 20 percent by corporate debt and 80 percent by industrial revenue bonds. TBS determined the interest rate on the corporate debt by adding a premium of 2.7 percent to the inflation rate assumed for the period 1981 to 1982. The tax-exempt interest rate was assumed to be two-thirds of the nonexempt interest rate. A marginal income tax rate of 50.1 percent was assumed, based on a marginal federal rate of 46 percent and a tax-deductible average state tax rate of 7.55 percent. An investment tax credit of 10 percent and the five-year capital recovery tax depreciation factors were assumed to apply to investments in pollution control equipment associated with steel mill equipment. A property tax rate of 2.38 percent of net book value was also assumed, based on 14-year straightline depreciation for book purposes.

Given the assumptions listed above, the inflation rate projection of 9.4 percent for 1981 implies a weighted average interest rate on pollution control debt of 8.91 percent:

$$(9.4 + 2.7) * .2 + .67 * (9.4 + 2.7) * .8 = 8.91\%$$

Using this discount rate to calculate the present value of $1.0 million investment in pollution control equipment yields an estimated present value of the outlay of $351,020. Annualizing this outlay over a 14-year period at the assumed rate of interest results in a level annual payment of $44,854 after taxes, which implies an outlay of $89,889 before taxes. Normalizing the before-tax outlay by the initial investment of $1.0 million results in a capital recovery factor for pollution control equipment of 0.0899.

4. Pollution Control Costs

Estimates of the total operating and capital recovery costs associated with in-place, BPT and BAT levels of water pollution control for each of the 12 plants were provided by the Cyrus Rice Division of NUS Corporation. Capital recovery costs were calculated using a capital recovery factor of 0.0899. PHB removed the capital recovery component from the estimate of operating costs for in-place equipment. In-place equipment represents a sunk cost, rather than a current investment decision, and thus provisions for capital recovery on incremental investment do not apply. Table D-2 summarizes the estimates of total operating costs associated with in-place water treatment facilities, plus total operating and capital recovery costs associated with BPT and BAT levels of water pollution control. The estimates have been inflated from 1978 dollars to 1980 dollars using an inflation factor of 1.25. This factor is consistent with the appropriate mix of price indices contained in the industrywide analysis.

PHB added the figures shown in Table D-2 to the production costs calculated by the plant models. Because the treatment cost estimates are predicated on a higher utilization than is likely to prevail in the near future, the estimates shown in Table D-2 may somewhat overstate the variable pollution control costs that might be incurred at these plants. However, any such overestimation, while not significant, serves only to reinforce PHB's conclusions.

Estimates of the operating costs associated with in-place air pollution control equipment were derived from estimating equations contained in the July 1979 PEDCo

Table D-2

WATER POLLUTION CONTROL
ESTIMATED OPERATING AND CAPITAL RECOVERY COSTS
($ 1980 M)

Model Configuration (Company/Plant)	In-Place	Additional Treatment Levels (Incremental) BPT	BAT	Total Additional Cost
Bethlehem Steel/ Lackawanna	4.36	1.16	1.03	2.19
Jones & Laughlin/ Cleveland	1.46	0.09	0.38	0.47
Jones & Laughlin/ Indiana Harbor	2.38	0.39	0.66	1.05
Kaiser Steel/ Fontana	2.59	0.90	0.25	1.15
McLouth Steel/ Trenton	6.24	0.24	0.28	0.52
National Steel/ Weirton	7.69	0.39	1.93	2.32
Republic Steel/ Gadsden	-1.18*	0.19	1.63	1.82
Sharon Steel/ Farrell	1.01	0.39	0.26	0.65
U.S. Steel/ Fairless	4.60	2.23	0.83	3.06
U.S. Steel/ Geneva	-1.49*	0.00	1.60**	1.60
U.S. Steel/ Homestead	-0.58*	0.44	0.30	0.74
Wheeling-Pittsburgh/ Steubenville	5.08	0.30	0.61	0.91

* Negative operating costs result from credits for by-products recovered such as mill scale, acid, etc.

** Includes some consent decree requirements.

Environmental, Inc. study for the EPA entitled Development of Air Pollution Control Cost Functions for the Integrated Iron and Steel Industry. The estimates were derived using the equation for the level of control, RACT, BACT, or LAER, specified by PEDCo as corresponding with the requirement contained in the typical State Implementation Plan (SIP) for each process with significant emissions, both fugitive and stack. The cost estimates derived from the PEDCo equations are based on the capacities of the various processes in each plant configuration and have been inflated from mid-1977 to 1980 dollars using a factor of 1.25. Because the estimates given by the equations reflect the cost of full compliance with the level of control specified in the typical SIP, the estimates have been adjusted to reflect the average 1980 percentage of compliance for each process reported in the industrywide study in conjunction with the Division of Stationary Source Enforcement of EPA. These percentage of compliance figures are summarized in Table D-3. The estimates of total operating costs for in-place air pollution control are summarized in Table D-4.

Table D-3

AIR POLLUTION CONTROL
PERCENTAGE OF COMPLIANCE FACTORS -- 1980

Process	Percent of Compliance	
	Stack	Fugitive
Ore Yard	95	95
Coal Yard	90	90
Sintering	80	60
Coke Ovens	NA	65
Blast Furnace	95	10
Open Hearth	75	25
Basic Oxygen	85	40
Electric Furnace	85	55
Continuous Casting	100	100
Primary Breaking	90	90
Pickling & Galvanizing	100	100
Other Finishing	80	80

SOURCE: Temple, Barker & Sloane, Inc., in conjunction with the Division of Stationary Source Enforcement of EPA.

Table D-4

AIR POLLUTION CONTROL
ESTIMATED DIRECT OPERATING COSTS

Model Configuration (Company/Plant)	Estimated In-Place Equipment ($ 1980 M)	Additional Equipment Required ($ 1980 M)	Total Operating Costs ($ 1980 M)	Total Operating Costs per Shipment Ton ($ 1980/NT)
Bethlehem Steel/ Lackawanna	3.67	1.57	5.24	2.62
Jones & Laughlin/ Cleveland	0.66	0.34	1.00	0.46
Jones & Laughlin/ Indiana Harbor	2.70	1.52	4.22	2.11
Kaiser Steel/ Fontana	4.50	0.52	5.02	3.14
McLouth Steel/ Trenton	0.66	0.27	0.93	0.52
National Steel/ Weirton	3.00	1.55	4.55	1.75
Republic Steel/ Gadsden	1.20	0.76	1.96	2.81
Sharon Steel/ Farrell	0.65	0.31	0.96	0.88
U.S. Steel/ Fairless	2.50	1.07	3.57	1.23
U.S. Steel/ Geneva	2.51	1.65	4.16	2.45
U.S. Steel/ Homestead	1.35	1.03	2.38	1.11
Wheeling-Pittsburgh/ Steubenville	2.80	1.50	4.30	2.10

SUMMARY OF SCREENING ANALYSIS — APPENDIX 1

The broad screening analysis used to determine which specific plants were most likely to be seriously affected by the effluent guidelines regulations involved ranking some 45 different plants of the 14 largest integrated domestic steel companies according to each of three indicative criteria. The three criteria used were product mix profitability, plant competitiveness and company financial strength. Although relative rankings of the plants were made for each criterion, the overall rating of each plant was based on a somewhat subjective review which attempted to take into consideration other relevant factors which were not adequately reflected in the analyses underlying the three specific rankings developed. For example, the replacement potential for each plant by another plant of the same company was considered. If other affiliated plants were able to provide similar products to the same markets as the plant in question, its vulnerability was increased.

The eventual selection of 12 specific plants was made in consultation with and with the approval of the Agency. Table 2-1 summarizes the categorical rating of each plant for each of the three indicative screening criteria. Plants marked with an asterisk are those that were eventually selected for further analysis of the likely economic impact of the regulation.

Table 1-1

SUMMARY OF PLANT SCREENING ANALYSIS

Plant	Financial Strength	Product Mix	Plant Competitiveness
ARMCO	A-		
Ashland		B-	B-
Butler		B-	B+
Houston		B+	B
Kansas City		B+	B+
Middletown		B	B-
BETHLEHEM	B+		
Bethlehem		A	B+
Burns Harbor		B	A
Johnstown		B+	B+
*Lackawanna		C+	B-
Sparrows Point		B	B-
Steelton		B+	B+
CF&I	A-		
Pueblo		A-	B
INLAND	A-		
E. Chicago		B	A-
INTERLAKE	B+		
Riverdale		B	C+
J&L/LTV	C		
Aliquippa		B	B+
*Cleveland		B-	B
Pittsburgh		B	A-
*E. Chicago		B	B-
Hennepin		C	B
KAISER	C+		
*Fontana		B	B
MC LOUTH	C		
*Trenton		B-	B

Table 1-1

SUMMARY OF PLANT SCREENING ANALYSIS
(continued)

Plant	Financial Strength	Product Mix	Plant Competitiveness
NATIONAL	B+		
Granite City		C+	B+
Ecorse		B-	B+
*Weirton		C+	B-
Portage		C	B
REPUBLIC	B+		
Buffalo		B	B-
Canton		B	B+
Cleveland		B-	B-
*Gadsen		B-	B-
S. Chicago		A-	B
Warren		B	B+
SHARON	B		
*Farrell		B-	B-
U.S. STEEL	B-		
Baytown		B+	B+
Braddock		B-	B-
Duquesne		B	B
Fairfield		B	B+
*Fairless		B	B-
Gary		B	B+
*Geneva		B+	B-
*Homestead		B+	B-
Lorain		B+	B
S. Chicago		B+	B+
WHLG.-PITT.	B		
Monessen		A	B-
*Steubenville		B-	B-
**ENVIRODYNE	C		
S. Chicago		B	C+

** Not selected due to uncertainty surrounding attempted reorganization under jurisdiction of bankruptcy court.

PRODUCT MIX PROFITABILITY

The product mix profitability portion of the screening analysis attempted to develop an indication of the profitability of each plant by categorizing the products produced at each plant in terms of "average" profitability. The "average" profitability of various general steel products was determined by calculating the cost of producing each product assuming a plant of industry-average size, with a production-weighted mix of furnace types and 1976 industry average charging ratios. The cost of producing each product at this hypothetical plant was calculated using the ADL/AISI database and 1978 factor prices. Costs per ton to produce each product were then compared with the average prices per ton realized in 1978 for each general product category. The 1978 product prices per ton were calculated from data contained in the Department of Commerce publication MA-33B, "Current Industrial Reports -- Steel Mill Products," by dividing the value reported for shipments to other companies by the reported tonnage shipped for each product category. Dividing the difference between price per ton and cost per ton (gross margin) by the price per ton resulted in an approximate return on sales measure for each product category. The products were then ranked in descending order of return on sales. Based on its relative ranking in terms of return on sales, each product was then placed into one of three general categories of profitability as measured by return on sales. Products with the highest indicated profitability were placed in Category A, less profitable products in Category B and least profitable products in Category C. The final step in the product mix analysis was to apply the product profitability categorization to the product mix at each specific plant to obtain an average categorization (A, B or C) for each specific plant.

The profitability categorization of each of 10 general products is summarized in Table 2-2. The very low or negative margins associated with tin mill products and galvanized products indicates that it is probably not economic to produce these products at a plant which does not have below average production costs as a result of economies of larger scale operations or technologically superior processes, such as continuous casters and basic oxygen furnaces. The impact of these plant-specific

Table 1-2

RETURN ON SALES FOR INDUSTRY AVERAGE PLANT

	Percentage Return on Sales*		
Product	Category A	Category B	Category C
Seamless Tube	.64		
Wire	.29		
Structurals	.26		
Welded Pipe	.21		
Bar and Rod		.14	
Hot Rolled Sheet		.14	
Plates		.12	
Cold Rolled Sheet			.07
Tin Mill Products			.03
Galvanized Products			-.01

NOTE: Intraproduct category mix differences, especially for pipe/tube and wire, may preclude cost and price from being exactly comparable. The purpose of this analysis is not to compute a precise margin for each product but rather to group them into three general categories according to profitability.

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* Price per ton minus cost per ton divided by price per ton.

indicators of lower production costs was considered in the plant competitiveness analysis described below.

The average profitability categorization for each plant is given in Table 2-3 on the following pages. Due to the lack of detailed information on the volume of production for each product at each plant, the "averaging" process involved in this analysis is more of a qualitative than a quantitative exercise.

PLANT COMPETITIVENESS

The second indicative criterion used to rank plants according to their likely degree of profitability was a measure of plant competitiveness. As mentioned above, scale of operations and type of technology used to produce steel can have an impact on profitability independent of product mix. In general, larger capacity blast furnaces, the absence of open hearth steelmaking, extensive use of continuous casting and the presence of on-site cokemaking tend to indicate lower cost steel production and therefore enhanced competitiveness. Table 2-4 summarizes a number of key competitive indicators for each plant. Due to the essentially qualitative nature of the data, the overall competitiveness ranking derived from these indicators is essentially a qualitative ranking, from A for the most competitive through C for the least competitive in terms of technology and configuration.

COMPANY FINANCIAL STRENGTH

The third indicative criterion PHB examined in order to determine the vulnerability of a given plant was the financial condition of its parent company. The company financial strength analysis focused on various financial ratios which serve as indicators of profitability, leverage and liquidity on a corporatewide basis. Gross margin and return on equity were used as measures of profitability, while debt to capitalization and cash flow to long-term debt (Beaver's Ratio) were used as measures of financial leverage. Days cash was used as a measure of liquidity.

The company financial strength analysis involved calculating the five ratios mentioned above for each of 14

Table 1-3

PRODUCT MIX PROFITABILITY BY PLANT

Plant	Products*	Profitability
ARMCO		
Ashland	HRS, CRS, galvanized	B-
Butler	HRS, CRS	B-
Houston	Plate, structural, bar, weld pipe	B+
Kansas City	Bar/rod, wire	B+
Middletown	HRS, CRS, galvanized, weld pipe	B
BETHLEHEM		
Bethlehem	Structural	A
Burns Harbor	Plate, HRS, CRS, TMP	B
Johnstown	Bar/rod, wire	B+
Lackawanna	CRS, bar, galvanized	C+
Sparrows Point	Plate, HRS, CRS, TMP, rod, wire weld pipe	B
Steelton	Bar, rail, weld pipe	B+
CF&I		
Pueblo	Rail, structural, bar/rod, wire	A-
INLAND		
E. Chicago	HRS, CRS, galvanized, bar, structural, plate	B
INTERLAKE		
Riverdale	HRS, CRS, weld pipe	B
J&L		
Aliquippa	HRS, CRS, TMP, bar/rod, weld pipe seamless tube	B
Cleveland	HRS, CRS	B-
Pittsburgh	Bar	B
E. Chicago	HRS, CRS, TMP, galvanized, weld pipe, seamless tube	B
Hennepin	CRS, galvanized	C

* In approximate order of volume

Table 1-3

PRODUCT MIX PROFITABILITY BY PLANT
(continued)

Plant	Products*	Profitability
KAISER		
Fontana	HRS, plate, weld pipe, TMP, galvanized	B
MC LOUTH		
Trenton	HRS, CRS	B-
NATIONAL		
Granite City	HRS, CRS, galvanized	C+
Ecorse	HRS, CRS	B-
Weirton	HRS, CRS, galvanized	C+
Portage	CRS, TMP, galvanized	C
REPUBLIC		
Buffalo	Bar	B
Canton	Bar	B
Cleveland	HRS, CRS, galvanized, bar	B-
Gadsen	HRS, CRS, galvanized, plate	B-
S. Chicago	Bar/rod, seamless tube, wire	A-
Warren	HRS, CRS, galvanized, bar, weld pipe	B
SHARON		
Farrell	HRS, CRS, galvanized	B-
U.S. STEEL		
Baytown	Plate, weld pipe	B+
Braddock	HRS, TMP, CRS	B-
Duquesne	Bar	B
Fairfield	HRS, CRS, TMP, galvanized, structural, rail, bar	B
Fairless	HRS, CRS, TMP, galvanized, bar/rod, weld pipe, wire	B
Gary	HRS, CRS, TMP, galvanized, bar, plate rail, seamless tube, weld pipe	B
Geneva	HRS, plate, structural, weld pipe	B+
Homestead	Plate, structural	B+
Lorain	Bar/rod, CRS, seamless tube, wire	B+
S. Chicago	Plate, structural, rod, rail	B+

* In approximate order of volume.

Table 1-3

PRODUCT MIX PROFITABILITY BY PLANT
(continued)

Plant	Products*	Profitability
WHEELING-PITTSBURGH		
Monessen	Rail	A
Steubenville	HRS, CRS, TMP, galvanized	B-
WISCONSIN/ENVIRODYNE		
S. Chicago	Bar	B

* In approximate order of volume.

Table 1-4

INDICATORS OF PLANT COMPETITIVENESS

Plant	Raw Steel Cap.	OH %	BOF %	EF %	% of Cap. Cont. Cast.	Ave. Blast Furn. Size	Coke Cap.	Blast Furn. Cap.	Coke Cap./ Blast Furn. Cap.
Armco									
Ashland, KY	2.2	0	100	0	0	1.0	0	2.0	0
Butler, PA	1.0	0	0	100	50	N/A	0	0	N/A
Houston, TX	1.5	0	0	100	0	.8	.4	.8	.50
Kansas City, MO	1.6	0	0	100	28	N/A	0	0	N/A
Middletown, OH	3.5	35	65	0	20	.67	1.5	2.0	.75
Bethlehem									
Bethlehem, PA	3.4	0	100	0	0	.88	2.0	3.5	.57
Burns Harbor, IN	5.3	0	100	0	19	1.8	1.6	3.5	.46
Johnstown, PA	1.2	0	0	100	0	N/A	.4	0	N/A
Lackawanna, NY	2.8	0	100	0	0	1.0	1.4	4.2	.33
Sparrows Point, MD	7.0	50	50	0	0	1.3	2.6	6.3	.41
Steelton, PA	1.4	0	0	100	0	N/A	0	0	N/A
CF&I									
Pueblo, CO	1.9	0	68	32	26	.25	.8	1.0	.80
Inland									
East Chicago, IL	9.0	27	71	2	18	.72	3.2	6.5	.50
Interlake									
Riverdale, IL	.9	0	100	0	0	.60	.5	1.2	.42

Table 1-4

INDICATORS OF PLANT COMPETITIVENESS
(continued)

Plant	Hot Strip Mill Cap.	Built	Mod.	Cont. Pick ?	Comp. Cont. ?	Census Region	Trans. Mode	Comp. Rating
Armco								
Ashland, KY	1.8	1953	1966	Y	Y	ESC	River	B-
Butler, PA	.9	1957		N	Y	MA	Rail	B+
Houston, TX	N/A			N	Y	WSC	Sea	B
Kansas City, MO	N/A			N	Y	WNC	River	B+
Middletown, OH	2.4	1968		N	Y	ENC	Rail	B-
Bethlehem								
Bethlehem, PA	N/A			N	Y	MA	Rail	B+
Burns Harbor, IN	3.5	1966		Y	Y	ENC	Lake	A
Johnstown, PA	N/A			N	Y	MA	Rail	B+
Lackawanna, NY	2.4	1935		N	Y	MA	River	B-
Sparrows Point, MD	3.1	1948	1964	Y	Y	SA	Sea	B-
Steelton, PA	N/A			N	Y	MA	Rail	B+
CF&I								
Pueblo, CO	N/A			N	Y	MTN	Rail	B
Inland								
East Chicago, IL	4.5	1965		Y	Y	ENC	Lake	A-
Interlake								
Riverdale, IL	.6			N	N	ENC	River	B-

Table 1-4

INDICATORS OF PLANT COMPETITIVENESS
(continued)

Plant	Raw Steel Cap.	OH %	BOF %	EF %	% of Cap. Cont. Cast.	Ave. Blast Furn. Size	Coke Cap.	Blast Furn. Cap.	Coke Cap./ Blast Furn. Cap.
Jones & Laughlin (LTV)									
Aliquippa, PA	3.5	0	100	0	13	.72	1.2	3.6	.33
Cleveland, OH	3.1	0	81	19	0	.90	0	1.8	0
Pittsburgh, PA	1.8	0	0	100	0	N/A	1.3	0	N/A
East Chicago, IL	5.5	45	55	0	0	.88	1.2	3.5	.34
Hennepin, IL	0	N/A	N/A	N/A	N/A	N/A	0	0	N/A
Kaiser									
Fontana, CA	3.6	0	100	0	13	.68	1.1	2.7	.41
McLouth									
Trenton, MI	2.4	0	75	25	90	.85	.6	1.7	.35
National									
Granite City, IL	2.5	0	100	0	40	.90	.7	1.8	.39
Ecorse, MI	6.2	0	80	20	22	.93	1.6	3.7	.43
Weirton, WV	4.0	0	100	0	34	.75	1.4	3.0	.47
Portage, IN	0	N/A	N/A	N/A	0	N/A	0	0	N/A
Republic									
Buffalo, NY	1.0	0	100	0	0	.40	.3	.8	.38
Canton, OH	1.5	0	0	100	53	N/A	.2	0	N/A
Cleveland, OH	4.4	39	61	0	23	.60	1.5	3.0	.50
Gadsden, AL	1.5	0	90	10	0	.40	1.8	.8	1.00
South Chicago, IL	2.0	0	60	40	0	1.3	.4	1.3	.31
Warren, OH	2.7	0	100	0	0	1.30	.6	1.3	.46

Table 1-4

INDICATORS OF PLANT COMPETITIVENESS
(continued)

Plant	Hot Strip Mill Cap.	Built	Mod.	Cont. Pick ?	Comp. Cont. ?	Census Region	Trans. Mode	Comp. Rating
Jones & Laughlin (LTV)								
Aliquippa, PA	1.6	1957		N	Y	MA	Rail	B+
Cleveland, OH	3.4	1964		Y	Y	ENC	Lake	B
Pittsburgh, PA	N/A			N	N	MA	River	A-
East Chicago, IL	5.0	1968		Y	Y	ENC	Lake	B-
Hennepin, IL	N/A			Y	Y	ENC	Rail	B
Kaiser								
Fontana, CA	1.8	1950	1957	Y	Y	PAC	Rail	B
McLouth								
Trenton, MI	2.4	1954		Y	Y	ENC	Lake	B
National								
Granite City, IL	2.4	1967		N	Y	ENC	River	B+
Ecorse, MI	4.4	1961		Y	Y	ENC	Lake	B+
Weirton, WV	3.1	1927	1955	Y	Y	SA	River	B-
Portage, IN	N/A			Y	Y	ENC	Rail	B
Republic								
Buffalo, NY	N/A			N	Y	MA	Lake	B-
Canton, OH	N/A			N	Y	ENC	Rail	B+
Cleveland, OH	3.0			Y	Y	ENC	Lake	B-
Gadsden, AL	1.3	1957	1967	Y	Y	ESC	Rail	B-
South Chicago, IL	N/A			N	N	ENC	Lake	B
Warren, OH	1.7	1961		Y	Y	ENC	Rail	B+

Table 1-4

INDICATORS OF PLANT COMPETITIVENESS
(continued)

Plant	Raw Steel Cap.	OH %	BOF %	EF %	% of Cap. Cont. Cast.	Ave. Blast Furn. Size	Coke Cap.	Blast Furn. Cap.	Coke Cap./ Blast Furn. Cap.
Sharon									
Farrell, PA	1.6	0	63	37	0	.50	0	1.0	N/A
U.S. Steel									
Baytown, TX	2.0	0	0	100	0	N/A	0	0	N/A
Braddock, PA	2.5	0	100	0	0	.63	1.9	2.5	.77
Duquesne, PA	3.0	0	83	17	0	.75	1.2	1.5	.77
Fairfield, AL	3.5	0	100	0	0	.45	1.8	2.7	.67
Fairless Hills, PA	4.1	82	0	18	7	.97	1.0	2.9	.34
Gary, IN	8.0	0	100	0	25	.59	3.6	6.5	.55
Geneva, UT	2.8	100	0	0	0	.67	1.3	2.0	.65
Homestead, PA	4.0	100	0	0	0	.58	1.5	2.0	.77
Lorain, OH	3.0	0	100	0	0	.54	1.5	2.7	.56
South Chicago, IL	5.2	0	78	22	21	.82	0	4.1	0
Wheeling-Pittsburgh									
Monessen, PA	1.6	0	100	0	0	.50	.5	1.5	.33
Steubenville, OH	2.8	0	100	0	0	.48	1.3	2.4	.54
Wisconsin/Envirodyne									
South Chicago, IL	1.2	0	100	0	23	.27	.3	.8	.38

Table 1-4

INDICATORS OF PLANT COMPETITIVENESS
(continued)

Plant	Hot Strip Mill Cap.	Built	Mod.	Cont. Pick ?	Comp. Cont. ?	Census Region	Trans. Mode	Comp. Rating
Sharon								
Farrell, PA	.5	1931	1962	Y	N	MA	Rail	B-
U.S. Steel								
Baytown, TX	N/A			N	N	WSC	Rail	B+
Braddock, PA	2.6	1938		Y	Y	MA	River	B-
Duquesne, PA	N/A			N	N	MA	River	B
Fairfield, AL	1.6	1937	1968	Y	Y	ESC	Rail	B+
Fairless Hills, PA	3.1	1953		Y	Y	MA	River	B-
Gary, IN	5.0	1967		Y	Y	ENC	Lake	B
Geneva, UT	N/A			N	N	MTN	Rail	B-
Homestead, PA	N/A			N	Y	MA	River	B-
Lorain, OH	N/A			N	Y	ENC	Rail	B
South Chicago, IL	N/A			N	Y	ENC	Lake	B+
Wheeling-Pittsburgh								
Monessen, PA	N/A			Y	N	MA	River	B-
Steubenville, OH	2.6	1926	1957	Y	Y	ENC	River	B-
Wisconsin/Envirodyne								
South Chicago, IL	N/A			N	Y	ENC	Lake	C+

major steel-producing corporations for the years 1977, 1978 and 1979. The only significant tonnage producer omitted was Ford, which does not report any separate information on its steel operations. Each of the five ratios mentioned above was calculated for each firm for each year. Based on the relative magnitude of each ratio for each year, each company was assigned a categorical rating, A, B or C. Each company's rating for each ratio was then combined into an overall rating reflecting a qualitative "average" of the ratings assigned to each individual ratio. Tables 2-5 through 2-9 summarize the five financial ratios and the categorical ratings for each firm. Table 2-10 summarizes the overall categorical rating of each firm's financial strength.

Table 1-5

FINANCIAL STRENGTH: GROSS MARGIN (%)

	MEASURE VALUE AND RATING			OVERALL
	1977	1978	1979	RATING
Armco	11.9 (B)	15.6 (A)	15.0 (A)	A-
Bethlehem	9.4 (C)	15.5 (A)	14.9 (A)	B+
CF&I	N/A	15.2 (A)	15.5 (A)	A
Envirodyne	13.7 (B)	5.8 (C)	(3.1)(C)	C+
Inland	14.6 (A)	17.5 (A)	14.6 (A)	A
Interlake	21.1 (A)	19.2 (A)	19.5 (A)	A
Kaiser	8.7 (C)	8.2 (C)	7.9 (C)	C
LTV	6.4 (C)	7.1 (C)	9.6 (C)	C
McLouth	4.0 (C)	9.5 (C)	9.8 (C)	C
National	7.7 (C)	13.4 (B)	11.8 (B)	B-
Republic	14.7 (A)	16.7 (A)	15.0 (A)	A
Sharon	12.4 (B)	17.5 (A)	14.6 (A)	A-
U.S. Steel	13.3 (B)	13.9 (B)	13.2 (B)	B
Whlg.-Pitt.	6.4 (C)	10.2 (B)	12.1 (B)	B-

A > 14
B 10 - 14
C < 10

Table 1-6

FINANCIAL STRENGTH: ROE (%)

	MEASURE VALUE AND RATING						OVERALL
	1977		1978		1979		RATING
Armco	8.3	(A)	12.6	(A)	12.9	(A)	A
Bethlehem	(16.5)	(C)	9.5	(A)	10.7	(B)	B
CF&I	N/A		5.8	(B)	7.2	(B)	B
Envirodyne	(29.7)	(C)	N/A		N/A		C
Inland	7.8	(B)	12.6	(A)	10.0	(B)	B+
Interlake	6.1	(B)	3.4	(C)	11.9	(A)	B
Kaiser	1.0	(C)	2.7	(C)	9.3	(B)	C+
LTV	(17.9)	(C)	7.6	(B)	24.9	(A)	B
McLouth	(8.9)	(C)	6.0	(B)	5.0	(C)	C+
National	4.7	(B)	9.4	(A)	8.9	(B)	B+
Republic	3.1	(C)	7.9	(B)	8.1	(B)	B-
Sharon	10.1	(A)	16.4	(A)	22.8	(A)	A
U.S. Steel	2.7	(C)	4.6	(C)	(6.0)	(C)	C
Whlg.-Pitt.	(7.5)	(C)	5.4	(B)	12.5	(A)	B
Inflation	6.0		7.3		8.9		

B = Within two points of inflation

Table 1-7

FINANCIAL STRENGTH: DEBT TO CAPITALIZATION (%)

	MEASURE VALUE AND RATING			OVERALL
	1977	1978	1979	RATING
Armco	31 (A)	28 (A)	25 (A)	A
Bethlehem	30 (A)	30 (A)	28 (A)	A
CF&I	N/A	29 (A)	28 (A)	A
Envirodyne	89 (C)	124 (C)	187 (C)	C
Inland	35 (A)	34 (A)	33 (A)	A
Interlake	22 (A)	31 (A)	29 (A)	A
Kaiser	35 (A)	42 (B)	39 (B)	B+
LTV	79 (C)	76 (C)	69 (C)	C
McLouth	44 (B)	42 (B)	40 (B)	B
National	36 (B)	34 (A)	32 (A)	A-
Republic	25 (A)	24 (A)	22 (A)	A
Sharon	17 (A)	17 (A)	66 (C)	C
U.S. Steel	31 (A)	29 (A)	32 (A)	A
Whlg.-Pitt.	38 (B)	35 (A)	30 (A)	A-

A < 35
B 35-50
C > 50

Table 1-8

FINANCIAL STRENGTH: BEAVER RATIO

	MEASURE VALUE AND RATING			OVERALL
	1977	1978	1979	RATING
Armco	.15 (B)	.36 (A)	.38 (A)	A-
Bethlehem	.03 (C)	.30 (A)	.33 (A)	B+
CF&I	N/A	.38 (A)	.43 (A)	A
Envirodyne	0 (C)	(.07)(C)	(.14)(C)	C
Inland	.22 (A)	.28 (A)	.24 (A)	A
Interlake	.17 (B)	.17 (B)	.19 (B)	B
Kaiser	.07 (C)	.05 (C)	.17 (B)	C+
LTV	.02 (C)	.04 (C)	.11 (C)	C
McLouth	.01 (C)	.13 (C)	.14 (C)	C
National	.18 (B)	.20 (B)	.20 (B)	B
Republic	.20 (B)	.29 (A)	.24 (A)	A-
Sharon	.20 (B)	.32 (A)	.09 (C)	B-
U.S. Steel	.14 (C)	.15 (B)	.14 (C)	C+
Whlg.-Pitt.	.03 (C)	.14 (C)	.22 (A)	B-

A > .20
B .15-.20
C < .15

Table 1-9

FINANCIAL STRENGTH: DAYS' CASH

	MEASURE VALUE AND RATING			OVERALL
	1977	1978	1979	RATING
Armco	4 (C)	13 (A)	5 (C)	B-
Bethlehem	16 (A)	18 (A)	16 (A)	A
CF&I	21 (A)	13 (A)	16 (A)	A
Envirodyne	20 (A)	2 (C)	2 (C)	B-
Inland	8 (B)	15 (A)	3 (C)	B
Interlake	7 (B)	9 (B)	4 (C)	B-
Kaiser	31 (A)	20 (A)	46 (A)	A
LTV	4 (C)	8 (B)	4 (C)	C+
McLouth	5 (C)	8 (B)	4 (C)	C+
National	N/A	26 (A)	11 (A)	A
Republic	7 (B)	11 (A)	8 (B)	B+
Sharon	15 (A)	5 (C)	79 (A)	B+
U.S. Steel	12 (A)	13 (A)	11 (A)	A
Whlg.-Pitt.	14 (A)	16 (A)	23 (A)	A

C < 5

B 5 - 10

A > 10

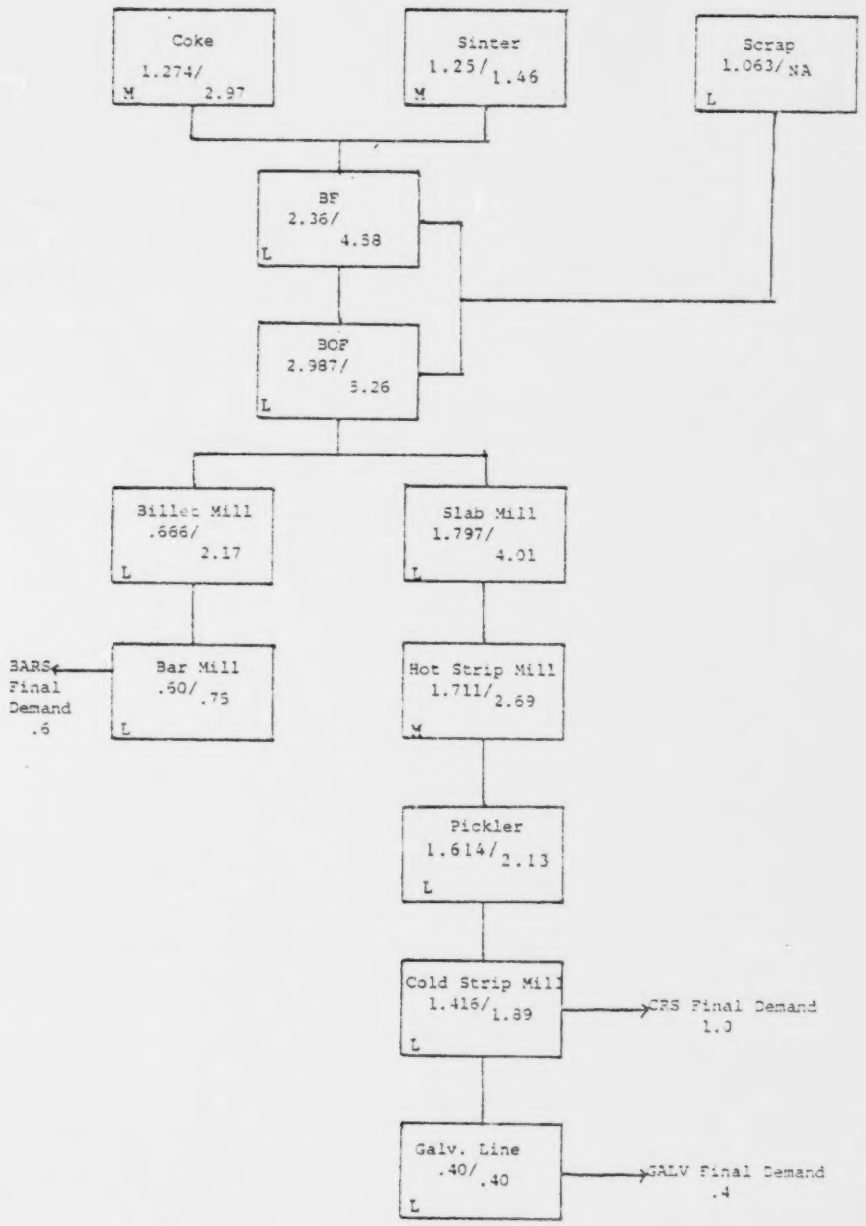
Table 1-10

FINANCIAL STRENGTH SUMMARY

	ROE	Gross Margin	Debt/ Cap.	Days' Cash	Beaver Ratio	Overall
Armco	A	A-	A	B-	A-	A-
Bethlehem	B	B+	A	A	B+	B+
CF&I	B	A	A	A	A	A-
Envirodyne	C	C+	C	B-	C	C
Inland	B+	A	A	B	A	A-
Interlake	B	A	A	B-	B	B+
Kaiser	C+	C	B+	A	C+	C+
LTV	B	C	C	C+	C	C
McLouth	C+	C	B	C+	C	C
National	B+	B-	A-	A	B	B+
Republic	B-	A	A	B+	A-	B+
Sharon	A	A-	C	B+	B-	B
U.S. Steel	C	B	A	A	C+	B-
Whlg.-Pitt.	B	B-	A-	A	B-	B

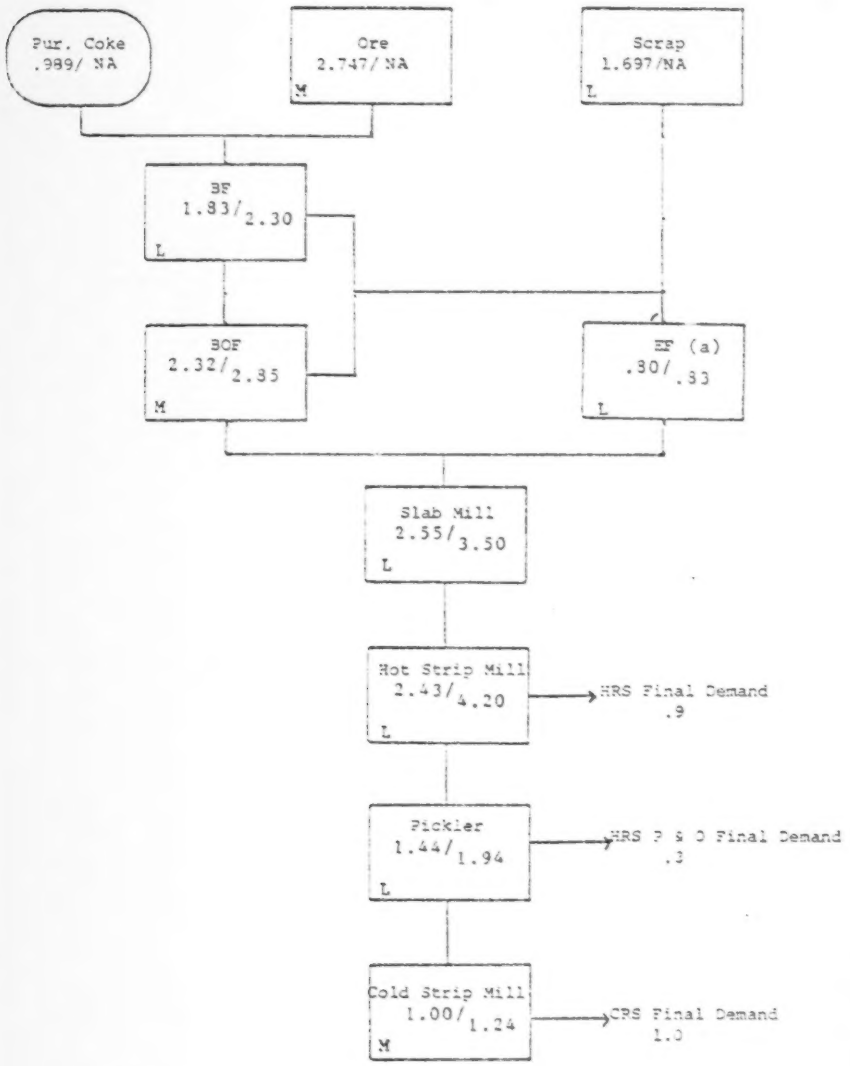
PLANT MODEL CONFIGURATIONS APPENDIX 2

BETHLEHEM STEEL
LACKAWANNA



Total Final Demand: 2.0 MNT finished products.

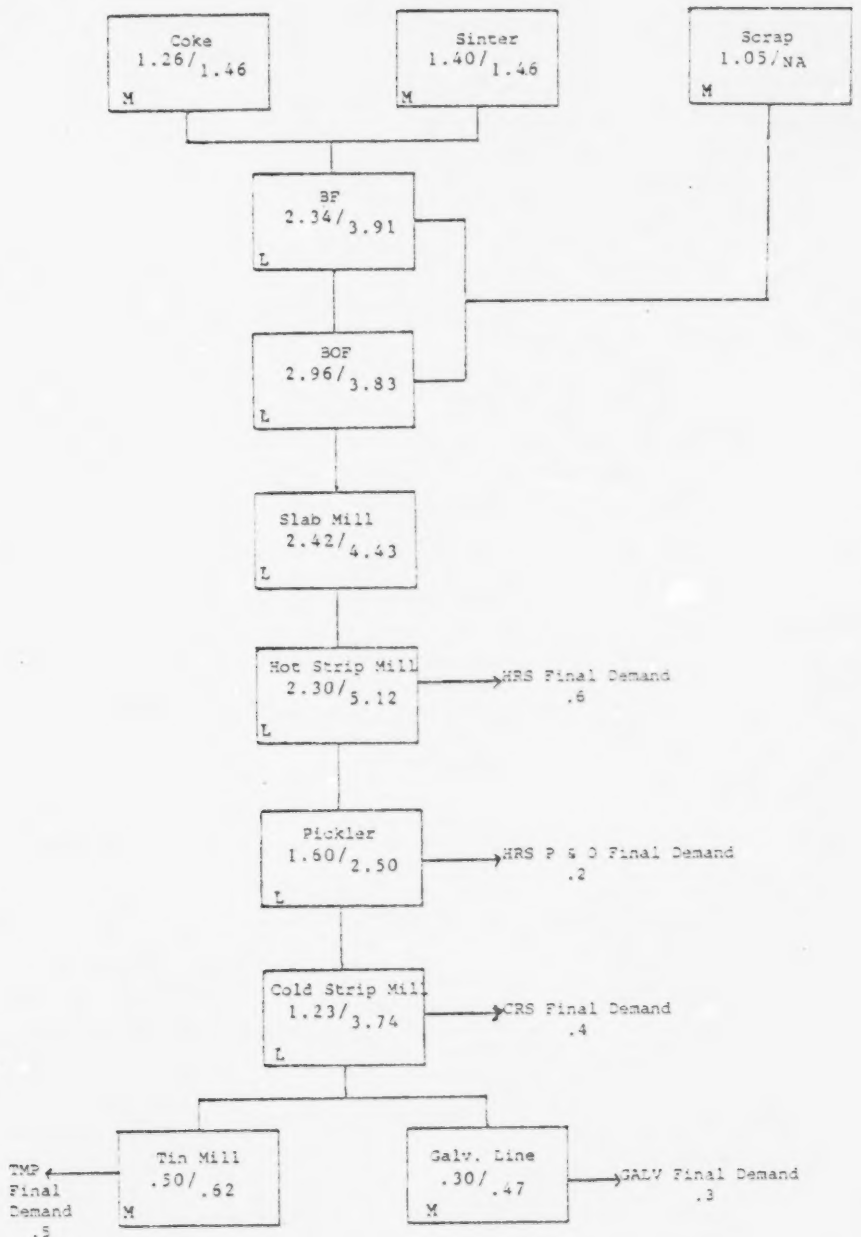
JONES & LAUGHLIN
CLEVELAND



Total Final Demand: 2.2 MNT finished products.

(a) Process constrained to operate at at least .8 MNT level; a binding constraint.

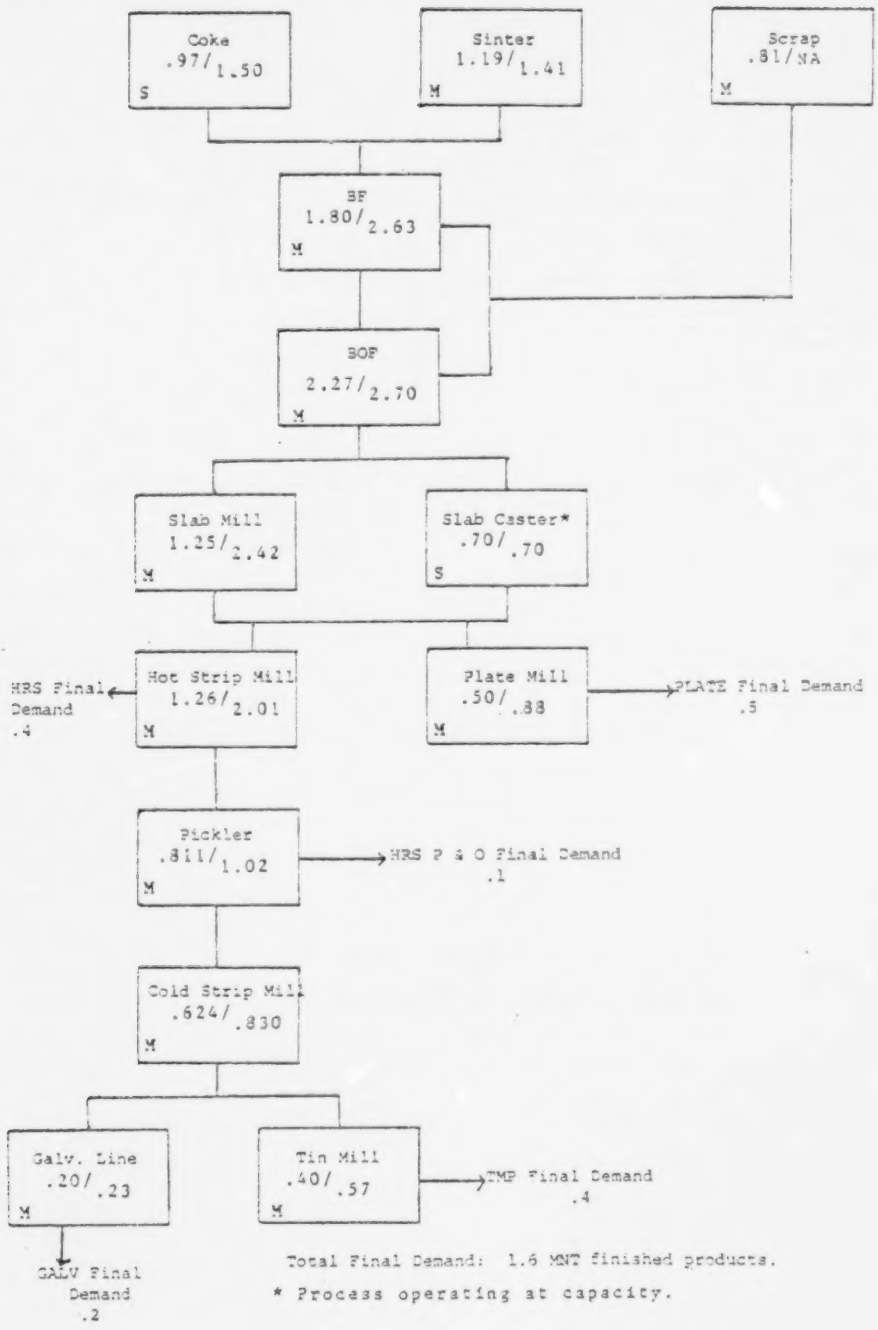
JONES & LAUGHLIN
INDIANA HARBOR



Total Final Demand: 2.0 MNT finished products.

Note: Seamless pipe mill (capacity: .31 MNT) omitted from this model. Mill uses billets provided by another plant.

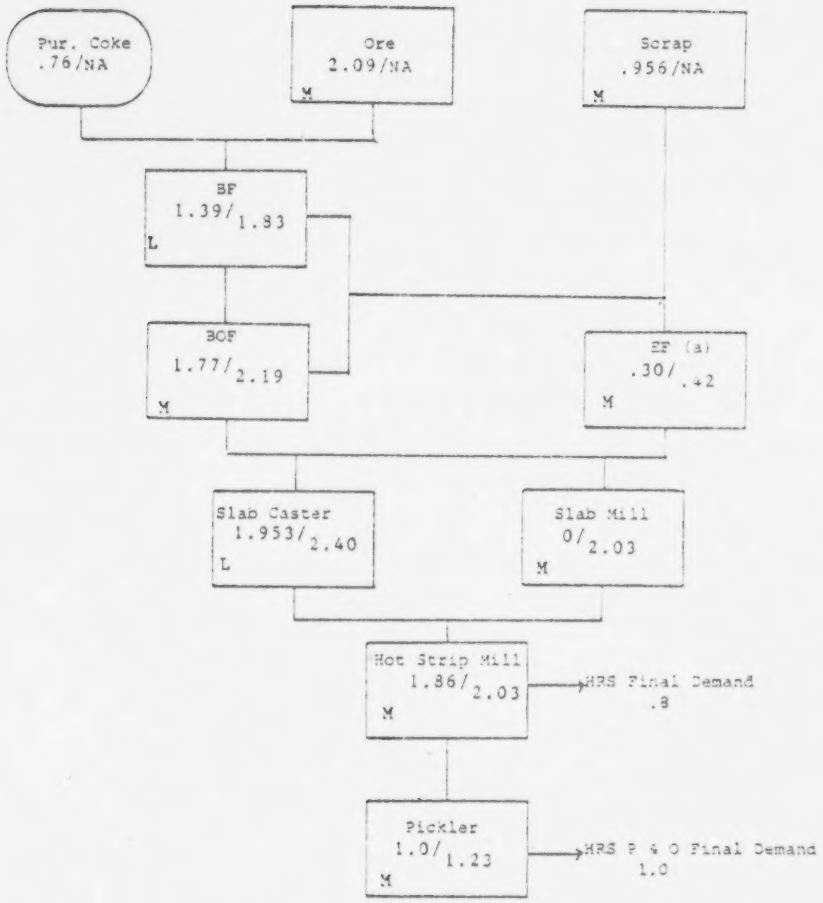
KAISER STEEL
FONTANA



Total Final Demand: 1.6 MMT finished products.

* Process operating at capacity.

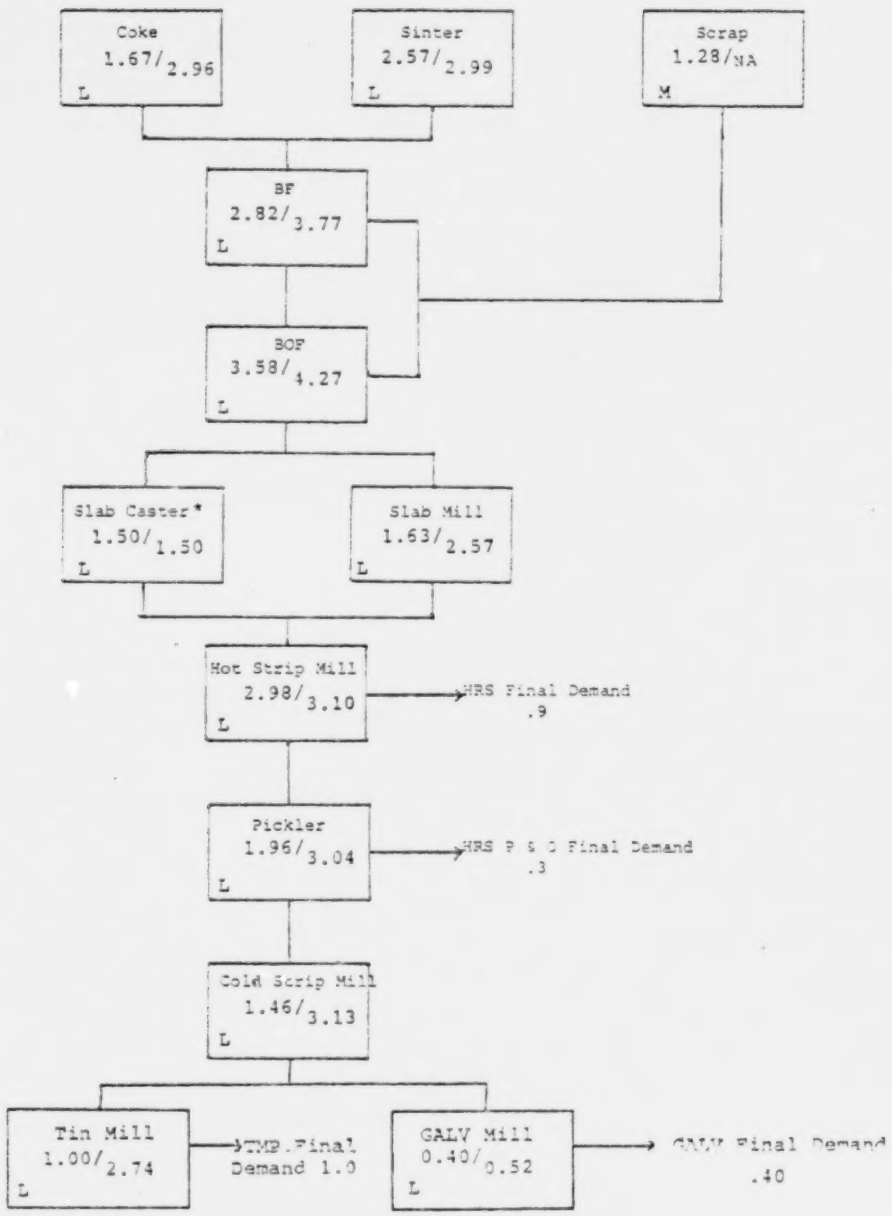
McLOUTH STEEL
TRENTON



Total Final Demand: 1.8 MNT finished products.

(a) Constrained to produce at least .3 MNT; a binding constraint.

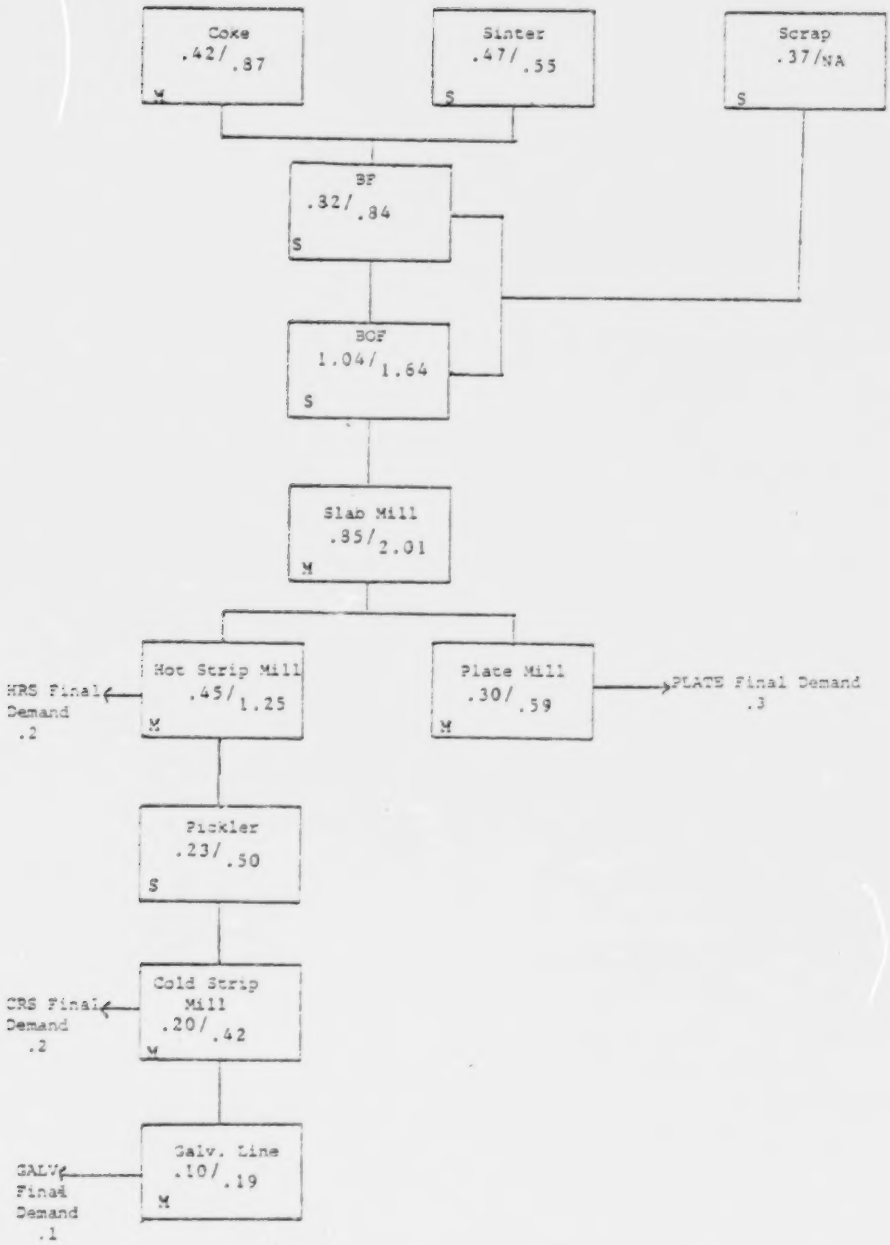
NATIONAL
WEIRTON



Total Final Demand: 2.6 MNT finished products.

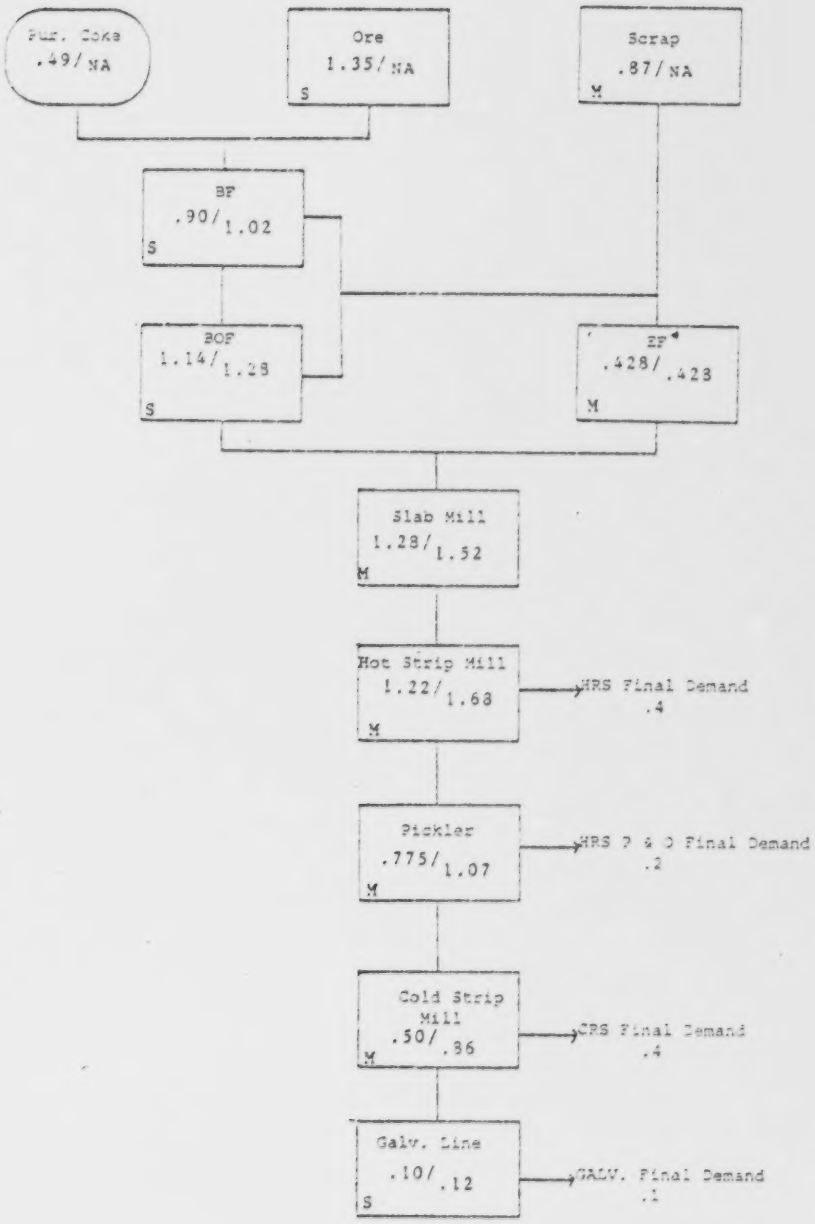
* Process operating at capacity.

REPUBLIC STEEL
GADSDEN



Total Final Demand: .7 MMT finished products.

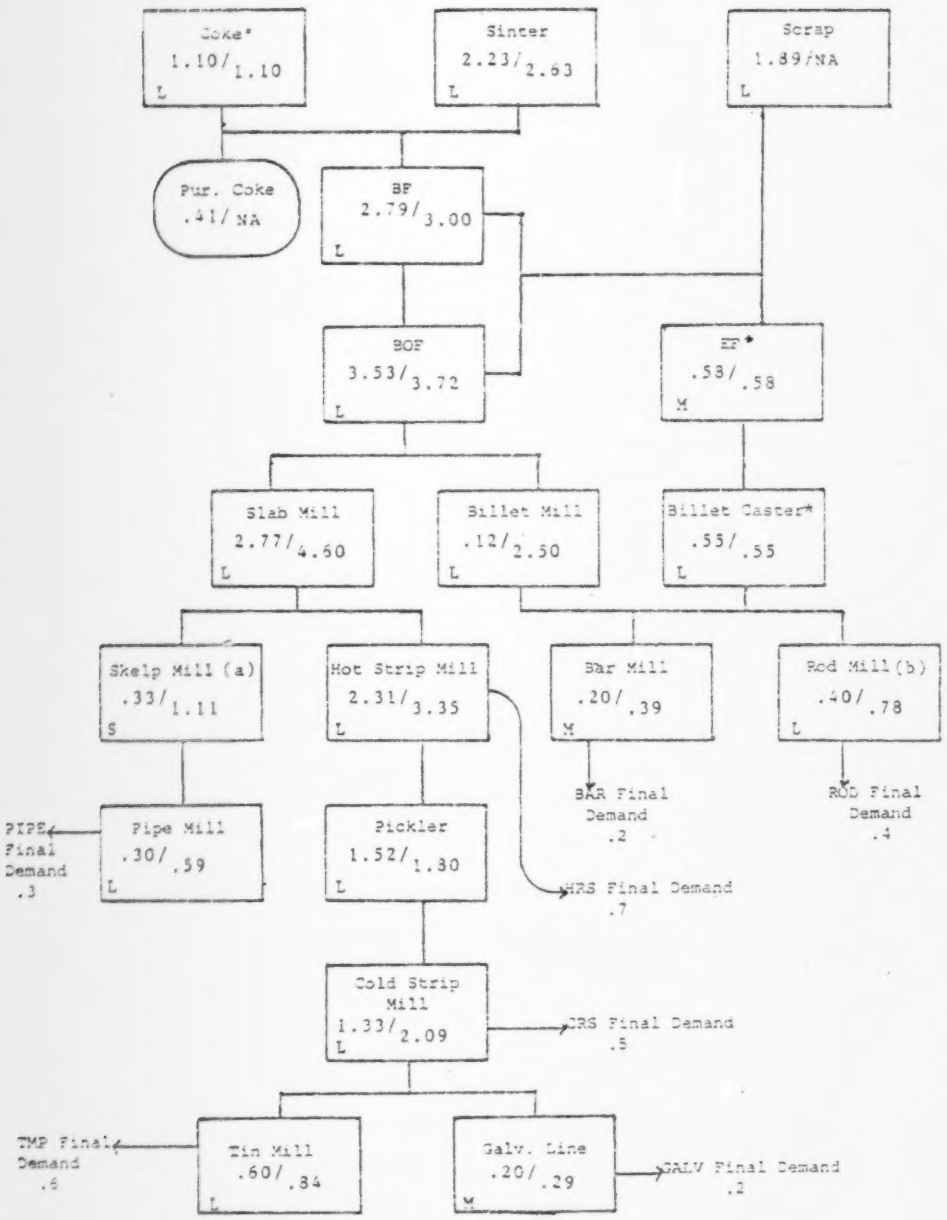
SHARON
FARRELL



Total Final Demand: 1.1 MMT finished products.

* Process operating at capacity.

U.S. STEEL
FAIRLESS

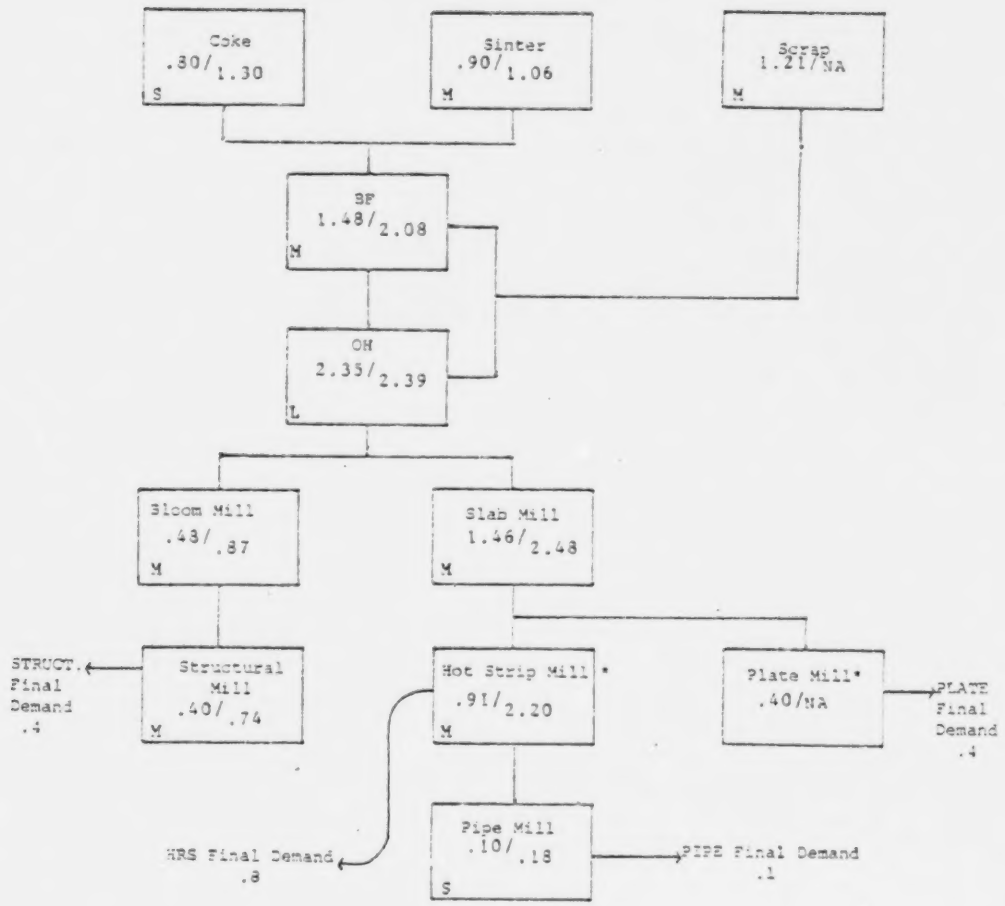


Total Final Demand: 2.9 MNT finished products.

* Process operating at capacity.

(a) Modelled as a small HSM.
(b) Modelled as a bar mill.

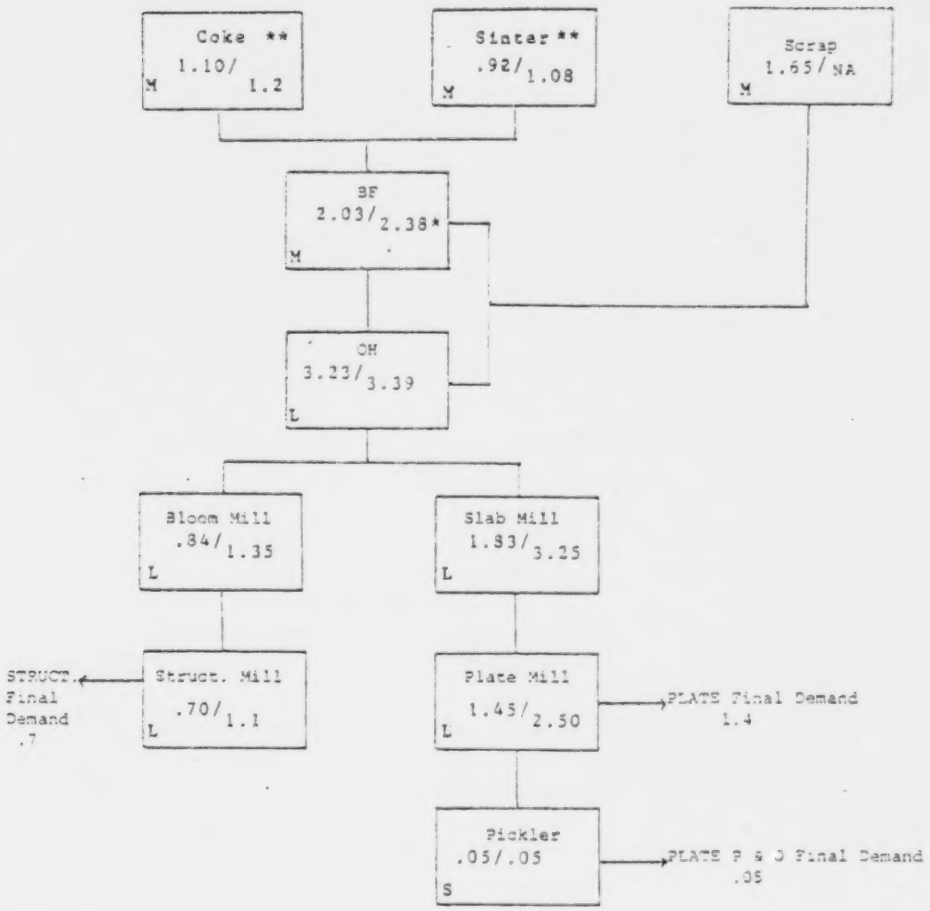
U.S. STEEL
GENEVA



Total Final Demand: 1.7 MNT finished products.

* Hot strip mill modelled as a combination of Hot Strip Mill and Plate Mill.

U.S. STEEL
HOMESTEAD

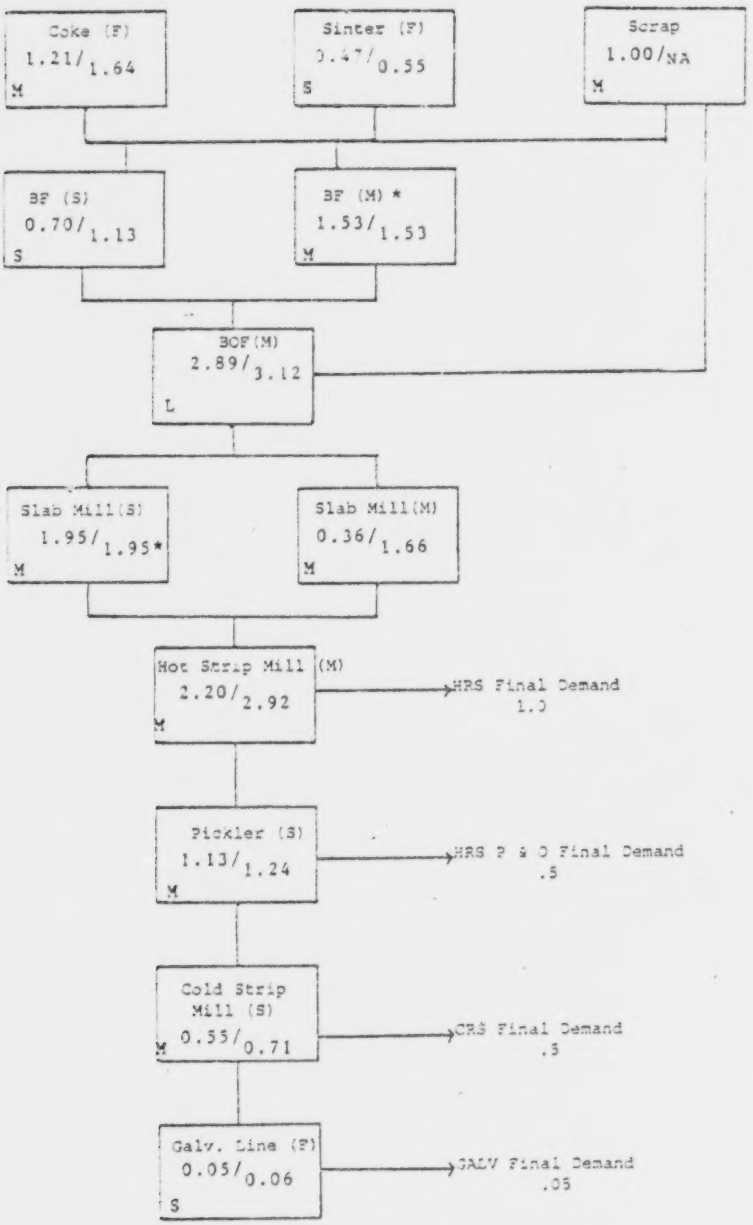


Total Final Demand: 2.15 MNT finished products.

* Includes excess blast furnace capacity available at Edgar Thomson Works, Braddock, PA.

**Hypothetical facility.

WHEELING-PITTSBURGH
STEUBENVILLE



Total Final Demand: 2.05 :NT finished products.

* Process operating at capacity.

F= Follansbee M= Mingo Junction S= Steubenville

SUMMARY OF MAJOR ASSUMPTIONS — APPENDIX 3

Standard economic theory suggests that a plant or individual production process within a plant is most likely to be closed if the present value of expected future cash flows attributable to the continued operation of the plant or process does not exceed the amount of fixed cash costs that can be avoided by closure less the present value of postponing closure costs. Pollution control regulations increase the expected fixed and variable costs of operating a given plant or process by imposing the additional costs of operations, maintenance and capital recovery associated with the required pollution control equipment. To the extent that these increased costs for a given plant or process are sufficient to change management's expectations regarding the likelihood that future contributions will exceed avoidable fixed costs, the pollution control requirements may contribute to a decision to close the plant or process.

Applying the general economic theory of plant or process closures to the task of predicting actual industry behavior in the face of a new environmental regulation is complicated by two basic problems: 1) lack of access to the same information available to industry decision makers, and 2) differing expectations regarding the future. This study has, of necessity, utilized a number of assumptions in order to cope with these inherent problems. The purpose of this appendix is to list these assumptions, explain why each was made, and provide a

justification for the conclusions that have been drawn from the analysis in terms of these assumptions.

1. AVERAGE OPERATING CHARACTERISTICS FOR EACH PROCESS

Due to the unavailability of confidential, plant-specific production cost data, PHB formulated the 12 individual steel plant models using the input factor usage rates and material balance yields contained in the ADL/AISI industry summary database made available to the Agency by the AISI. The ADL/AISI industry summary database reflects the average operating characteristics of each process across all plants in the original database. Therefore, use of the ADL/AISI database entails the implicit assumption that each process at each plant has industry-average operating characteristics. This assumption is justified on the grounds that the ADL/AISI industry summary database constitutes the best available information. Furthermore, basing a closure impact study on plant models reflecting industry-average operating characteristics for each process tends to distinguish plants which are marginal because of operating inefficiencies relative to the rest of the industry from those that are marginal due to the impact of the regulation.

2. EACH PLANT PAYS AVERAGE PRICES FOR FACTOR INPUTS

Due to the unavailability of plant-specific input factor cost data, PHB estimated production costs for each of the 12 plants modeled using the average input factor costs contained in the Agency's industrywide study. These costs tend to reflect national averages, or else regional averages corresponding to the principal steelmaking areas of Chicago, Cleveland and Pittsburgh. In the case of labor, the figure contained in the current nationwide United Steelworkers of America contract was used. In the case of raw materials, power and fuel, various regional averages were used on the grounds that these constitute the least speculative figures available. In addition, basing a closure impact study on the assumption that each plant pays average prices for factor inputs tends to distinguish plants which are marginal because they cannot

obtain their inputs at prices similar to those paid by their principal competitors from those that are marginal due to the impacts of the regulation.

Determining the exact prices being paid at a particular plant for raw material inputs, such as ore, coal and purchased coke, is complicated by the fact that most steelmakers either purchase these materials under long-term contracts, or control their own sources of these materials through full or partial ownership in iron mines, coal mines, coke batteries located at affiliated plants and even the railroads used to transport these materials. This integration results in transfer prices which are based on accounting practices rather than market value. Furthermore, maximum efficiency in cokemaking and ironmaking often requires blending of raw materials from several different sources. The phenomena of long-term contracts, captive control and blending make any outside attempt to ascertain potential differences in raw materials costs between individual plants extremely speculative.

In the case of purchased scrap and electric power, somewhat more definitive statements can be made regarding the likely source of the input and its probable cost. The cost of both of these inputs varies substantially by region. In the case of scrap, the price used reflects the average reported price for #1 heavy melting steel scrap for Pittsburgh, Chicago and Philadelphia. Although Kaiser Steel's Fontana plant is located in southern California and Republic Steel's Gadsden plant is located in Alabama, neither of these plants operates a scrap-intensive electric furnace shop. Thus any error introduced by the use of the average scrap price from other regions is likely to be very small.

A similar argument holds in the case of electricity. Electricity prices were calculated as total utility revenues divided by total utility energy sales to commercial and industrial large power users in the East North Central region of the country. Although the Fontana and Gadsden plants are located outside of this region, neither plant operates a power-intensive electric furnace shop. Thus any error introduced by use of an electricity price derived from other regions is likely to be small.

3. PLANT-SPECIFIC PRODUCT MIX AND GRADE MIX ASSUMPTIONS

Plant-specific information regarding finished product mix and grade mix (carbon, alloy or stainless steels) is generally considered by steel companies to be extremely confidential information. The most recent plant-specific production data available for purposes of this study is that contained in the company's original responses to 308a questionnaires which cover the years 1974 through the first half of 1976. Given the shifts in the pattern of product demand since 1976, particularly for such products as seamless and welded pipe, which are now in considerable demand, as opposed to automotive flat rolled sheet, which is currently in a very depressed market, it was necessary to make some adjustments to the likely product mix produced at each plant in order to reflect more accurately the probable expectations of management. With regard to grade mix, the ADL/AISI industry summary database was compiled based on the industry-average production grade mix in 1976, which has not changed substantially in recent years. Thus it was assumed that each plant modeled produces approximately the industry-average grade mix, an assumption which was true as of 1976, but may have changed in the intervening years. The smaller capacity plants, such as Sharon, have the potential to increase their presence in the markets for stainless and alloy specialty steels. In the absence of specific data to the contrary, PHB has assumed an industry-average grade mix and the demand-adjusted product mix shown in Table D-1.

4. AIR POLLUTION CONTROL COSTS

In the absence of plant-specific information regarding the operating costs of air pollution control equipment (both that already in place and that expected to be installed), PHB assumed that these costs could be derived from the estimating equations contained in the July 1979 PEDCo Environmental, Inc. study for the EPA entitled Development of Air Pollution Control Cost Functions for the Integrated Iron and Steel Industry. The estimates were derived using the equation for the level of control, RACT, BACT, or LAER, specified by PEDCo as corresponding with the requirement contained in the typical State Implementation Plan (SIP) for each process with significant emissions, both fugitive and stack. The

cost estimates derived from the PEDCo equations are based on the capacities of the various processes in each plant configuration and have been inflated from mid-1977 to 1980 dollars using a factor of 1.25.

* * * * *

The preceding assumptions are sufficient to calculate production costs for each of the plant configurations of interest, assuming industry average operating characteristics and national average factor input prices. However, there is some uncertainty associated with these estimates, due mainly to the age of the ADL/AISI database. Yields, material usages, and labor productivity may have changed since the data were collected.

In addition to these cost uncertainties, two other factors which are difficult to estimate are important to a closure analysis. The first of these is contingent liabilities associated with closure.

Although closure of a plant results in the avoidance of costs associated with continued production there usually are additional costs incurred to accomplish the closure. Contingent liability costs associated with plant closure in the iron and steel industry typically include severance pay, the cost of funding pension and disability insurance liabilities and the cost of settling outstanding raw material supply contracts. These costs may or may not be exceeded by the salvage or market value of the plant's assets. In the case of U.S. Steel in 1979 and Bethlehem Steel in 1977, these closure costs far exceeded the salvage value. If the present value of the contingent liabilities associated with closure exceed the realizable present value of the closed plant assets, closure costs will represent a loss to the firm and each year's decision to operate the plant will have the benefit of postponing the realization of these closure costs. In general, a decision to operate the plant will be justified provided that the loss from operations does not exceed the present value of the benefit achieved by postponing closure costs. The magnitude of the present value benefit associated with postponing closure depends on the magnitude of the contingent liabilities net of salvage value and the discount rate attributable to company funds.

The relative magnitudes of the contingent liabilities, plant salvage values and the discount rate attributable to company funds vary greatly according to a number of plant and company specific factors. As a result, the value of postponing closure is very difficult to estimate without access to company confidential data.

The second factor is the amount of ongoing investment necessary to maintain plant or process efficiency and hence profitability. These scheduled cash outflows are properly taken into account in a closure analysis. However, the schedule and magnitude of such maintaining investment varies widely by plant and by process and cannot be reliably estimated without access to company confidential data.

A classical closure analysis would have been difficult without access to company-specific confidential data. In view of this fact, an analysis of the per shipment ton cost impacts of the regulation was undertaken. The results of this analysis indicate that the per ton costs of the regulation are very small relative to the total variable costs of steel production. Independent of the uncertainty in production costs, deferred closure benefits, and prospective maintaining investment, it is extremely unlikely that the added cost due to the regulation, averaging only $0.82 per shipment ton, would by itself result in a closure decision. The results of this cost-based analysis are sufficient to support the conclusion that no closure decisions would be likely to result.* Thus it was not necessary to obtain these plant-specific, confidential data, or to complete a classical closure analysis.

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* This is not to say that no closures will occur at these plants, but rather that the regulation is very unlikely to be the cause of any such closure.